

Intracerebral Hemorrhage

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Disclosures

- ▶ I have no financial relationships or other conflict of interests to disclose, and I will not discuss off label use and/or investigational use in my presentation
- ▶ Research grants:
 - ▶ PI for SHINE
 - ▶ Local University Funded Pilot project
 - ▶ Co PI on multiple Stroke Net projects
- ▶ Ownership interest in xxx
- ▶ Consultant for xxx



Stroke Page Goes off

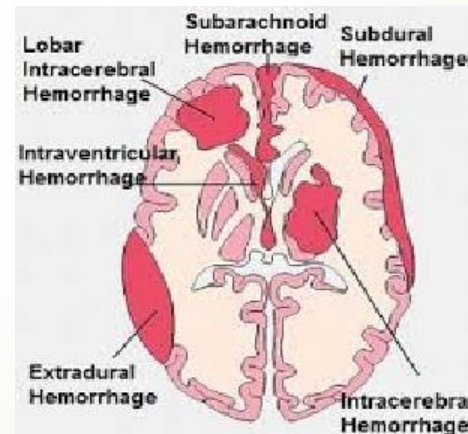
- ▶ 65 old Male with Left hemiplegia. Patient alert. GCS of 15. HR 68, BP 200
 - ▶ ABC
 - ▶ NIHSS
 - ▶ What next and Why?

Correct to rule out Hemorrhage



Classification

- EDH
- SDH
- SAH
- **IPH**
 - Lobar
 - Central





IPH: Epidemiology

- 10-15% of all strokes in US
- Affects yearly 37,000 to 54,000 patients in US
- Yearly incidence rate of 10-12 per 100,000
- Men > women
- Age
- High mortality: 30-52% of subjects dead at 1 month
- Economic burden: \$6 billion per year in US. Lifetime cost \$125,000/person/year.



Presentation

- ▶ Acute Onset “Focal Neurological Deficit”
- ▶ Headache in 40-50% of patients
- ▶ Alteration of consciousness in ~50%
- ▶ Other symptoms associated with location, ICP Changes




Diagnosis

- Clinical criteria - not sensitive nor specific
- CT - can accurately depict site, size
 - 100% sensitivity
- MRI – if available is acceptable alternative
- Angiogram low yield if > 45 age, hypertension and thalamic/pontine/putaminal ICH



IPH Etiology

- ▶ Primary (Spontaneous)
 - ▶ HTN: Most common 75%
 - ▶ Location: Thalamic/Basal Ganglia/Caudate.
 - ▶ Cerebral Amyloid Angiopathy
 - ▶ 70 yrs.
 - ▶ Annual risk 10%
- ▶ Traumatic
 - ▶ Any location.
- ▶ Secondary
 - ▶ Multiple vascular pathologies.



Etiology: Secondary


- ▶ Vascular malformations
 - ▶ Arteriovenous malformations
 - ▶ Dural arteriovenous fistulas
 - ▶ Cavernous angioma
- ▶ Aneurysms
- ▶ Tumors
- ▶ Hemorrhagic transformation of an ischemic infarct
- ▶ Venous Hemorrhage (venous sinus thrombosis)
- ▶ Moyamoya disease



Back to Our Patient

- ▶ Patient is still protecting airway and asking What Next?
- 

Golden Hour

- 
- ABC's
 - ICH score
 - History: anticoagulation, Trauma
 - Labs: CBC/BMP/INR
 - Reverse Coagulopathy
 - Blood Pressure



Golden Hour

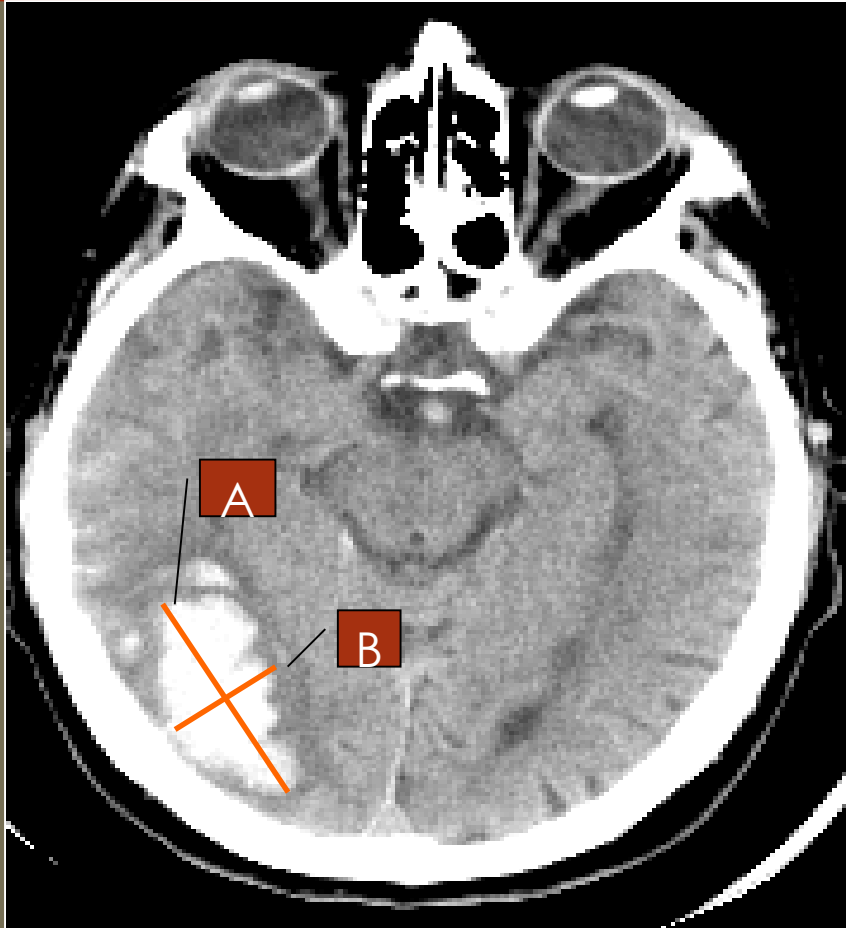
- ▶ Platelet transfusion – PATCH trial
- ▶ Assess for ICP elevation
- ▶ EVD/Pressure Monitoring
- ▶ Surgical eval and Rx
- ▶ Trend the Growth – close monitoring --- Neuro ICU



Reverse Anticoagulation

- Assess for it
- Reverse it expeditiously
- Formal processes in place.
- FFP
 - Rewarming
 - Rate of Transfusion
- NOVAC – reversal agents

ABC/2



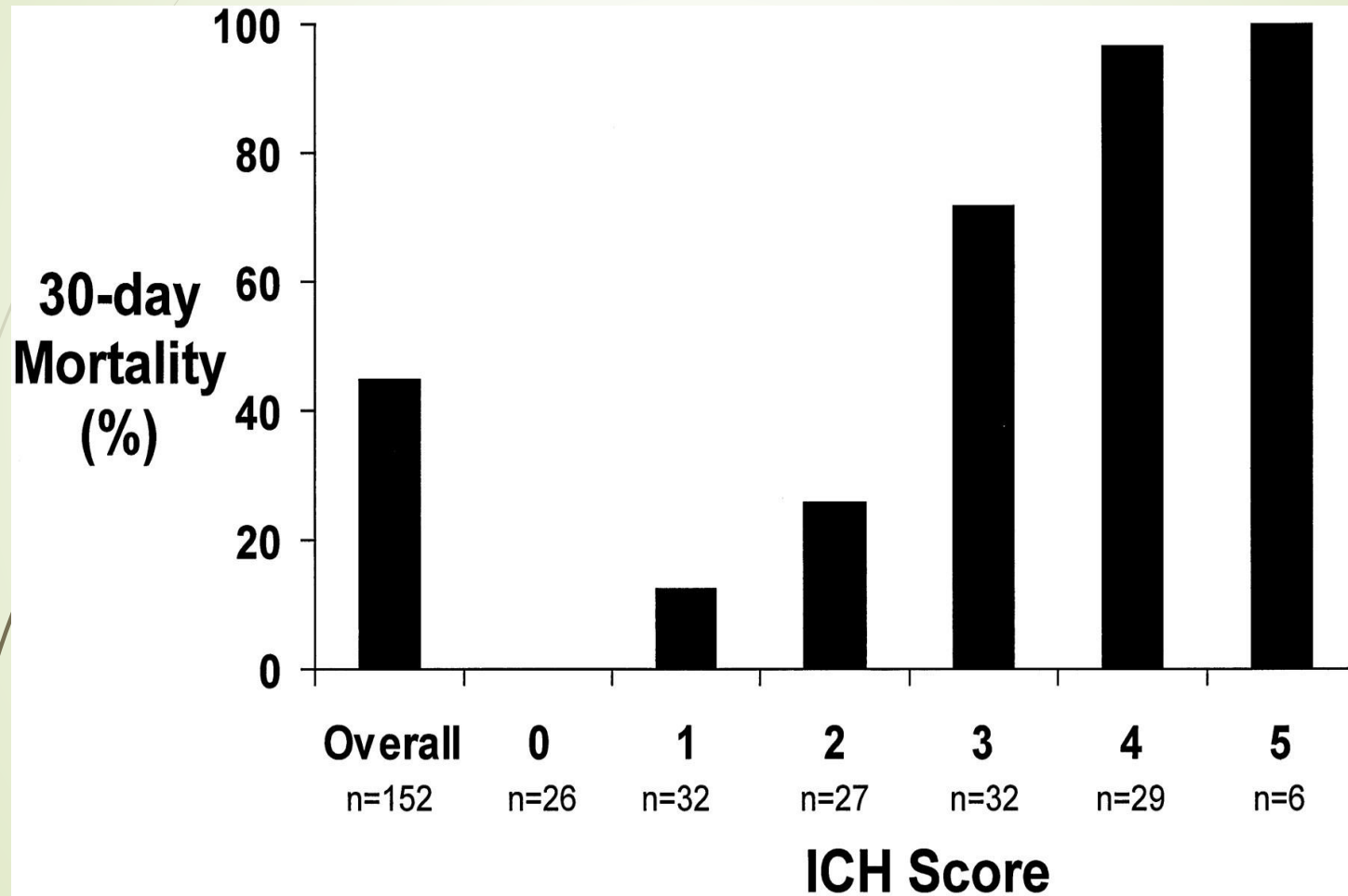
- A=greatest hemorrhage diameter by CT
- B=is the diameter 90 degrees to A
- C=is the approximate number (of 10 mm slices) with hemorrhage



ICH Score

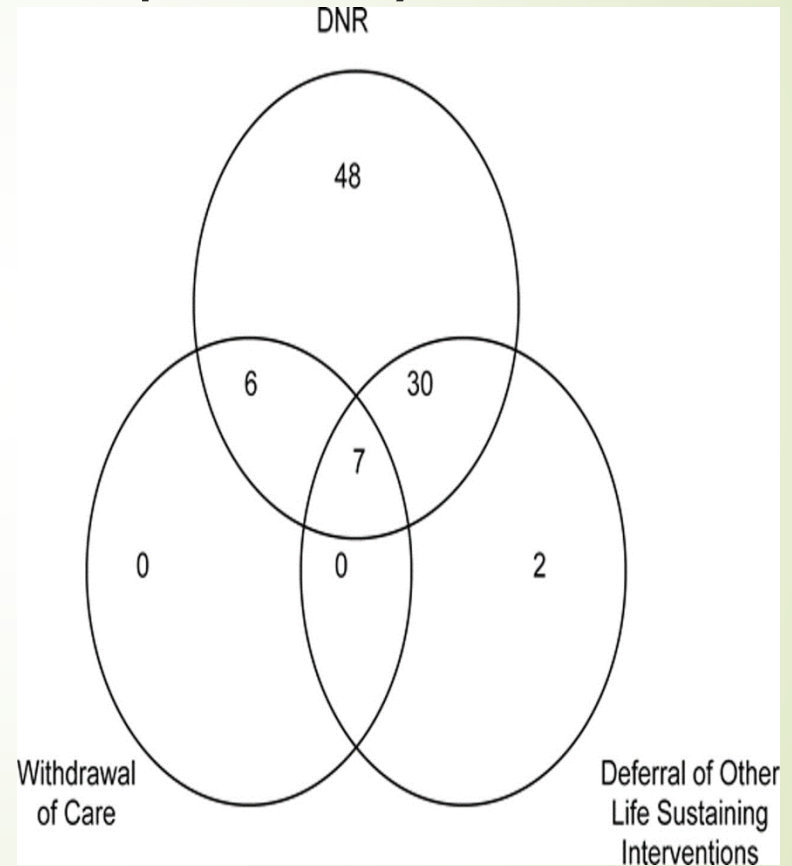
- ▶ GCS
 - ▶ 3-4 = 2 points
 - ▶ 5-12 = 1
 - ▶ 13-15 = 0
- ▶ ICH volume
 - ▶ ≥ 30 cc = 1
 - ▶ < 30 cc = 0
- ▶ IVH
 - ▶ Yes = 1
 - ▶ No = 0
- ▶ Infratentorial location
 - ▶ Yes = 1
 - ▶ No = 0
- ▶ Age
 - ▶ ≥ 80 = 1
 - ▶ < 80 = 0
- ▶ Total score 0-6

ICH score



Early DNR in ICH self fulfilling prophecy

- Population based study. 270 Pts.
- Early DNR in 34% of cases and was associated with a doubling in the hazard of death both at 30 days despite adjustment for age, gender, ethnicity, GCS, ICH volume, IVH and infra tentorial location





Back to Patient

- Patient getting Drowsy
- What do we do

Causes of worsening

- ▶ Acute Stage within 24 hours
 - ▶ Expansion of bleed
 - ▶ Hydrocephalus
 - ▶ Seizures in all stages
- ▶ Early Stage 2-5 days.
 - ▶ Edema – ICP elevation-herniation
- ▶ Late After 5 days
 - ▶ Other Medical complications



Secondary Deterioration

Study	Patients included	Initial GCS	Definition of deterioration	Frequency of Deterioration	Predictors of Deterioration
Mayer et al. (1994)-	GCS > 8 (n=46)	within 24 hours of onset-	Decrease in GCS > 2 points during hospital stay	15 (36%) mass effect	Hematoma volume,
Qureshi et al. (1995)-	GCS > 12 (n=95)-	at EMS presentation-	Decrease in GCS > 3 points within first 24 hours	22 (32%) mean time to deterioration 7.9±5.1 hours	Hematoma volume, ventricular extension

Abbreviations used: GCS: Glasgow Coma Score



Hemorrhage Expansion

- ▶ Cincinnati Study
 - ▶ CT within 3 hours of sx onset
 - ▶ 2 more CT's at +1 hour and +20 hours
 - ▶ ICH growth defined as >33% volume increase
 - ▶ 103 patients enrolled
 - ▶ Growth present in 26% of the patients at 1 hour
 - ▶ In 38% at 20 hours
 - ▶ Associated with worsening exam, worse outcome

Hemorrhage expansion

Study	Patients included	Definition of enlargement	Rate of enlargement	Definition of clinical deterioration	Clinical correlation	Risk factors
Kazui et al (1996)	204	Increase in hematoma size by 12.5 cm ³ ; or 40% increase compared with baseline	≤ 3 hours: 36% 3-6 hours: 16% 6-12 hours: 15% 12-24 hours: 6% 24-48 hours: 0%	Aggravation of consciousness or neurological deficit	66% of patients with hematoma enlargement deteriorated (14% without enlargement deteriorated)	Systolic BP ≥200mm Hg Serum glucose ≥141mg/dl Time of presentation
Brott et al. (1997)	103 patients who presented < 3 hours	33% increase in hematoma volume compared with baseline volume	< 1 hour: 26% 1-20 hours: 12%	>2 point decrease in GCS	31% of patients with hematoma enlargement deteriorated (10% without enlargement deteriorated)	



Back to Patient

- ED calls
 - INR reversed
 - BP under control
 - What is next?



In Hospital Monitoring

- ▶ Neuro ICU – Nursing Care
- ▶ Airway Monitoring
- ▶ Hemodynamics
 - ▶ Arterial catheter
- ▶ Hourly Neuro Checks
- ▶ Risk of secondary deterioration
- ▶ ICP monitoring



Seizures in ICH

- ▶ Common, up to 4-20% within first 30 days
- ▶ Most are within the first 72 hours
- ▶ Increased recognition of subclinical seizures (up to 30% of patients)
- ▶ Routine prophylaxis linked to worse outcomes in retrospective series



DVT ICH

- Symptomatic DVT in first 2 weeks up to 3-7%
- PE 1-2%
- DVT prophylaxis using enoxaparin or SQ heparin after the second day Safe but scary
- Pneumatic compression devices are superior to compression stockings

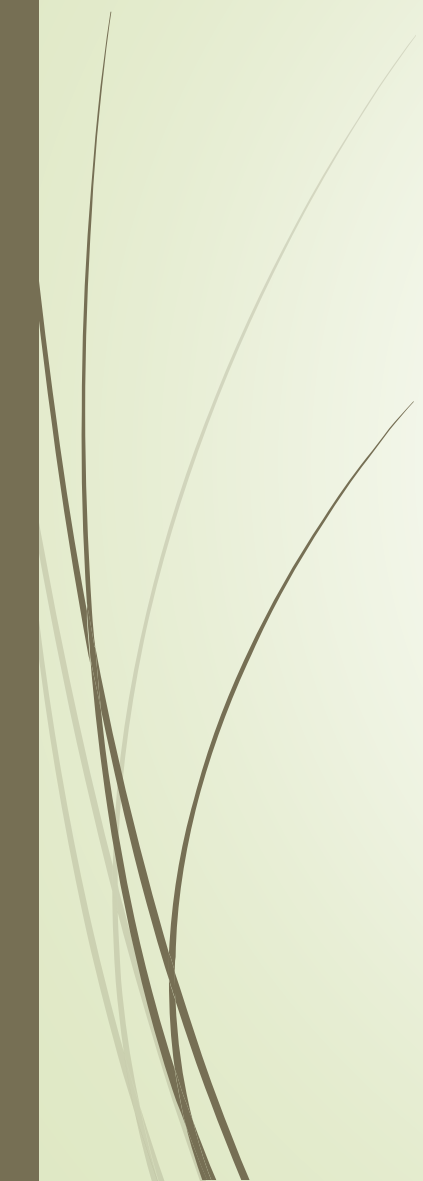


Other Cares

- Hyperglycemia
 - Normothermia
 - Nutrition
 - PT/OT/Rehab
 - Early PEG/Trach
 - Stimulants
- 



Special Circumstances

- Cerebellar Hemorrhage
 - IVH
- 



Cerebellar Hemorrhage

- ▶ Early Decompressive Surgery
 - ▶ Surgical Emergency
 - ▶ Decrease LOC
 - ▶ Brain Stem Compression
 - ▶ Hematoma size > 3cm
 - ▶ Hydrocephalus
 - ▶ EVD may worsen – upward herniation

Intraventricular ICH





- ▶ Ventricular blood is associated with increased mortality
 - ▶ Obstructive hydrocephalus
 - ▶ Intraventricular tPA
 - ▶ CLEAR trial
 - ▶ Endoscopic Rx
 - ▶ No clear Data



CLEAR IVH

- Phase II trial
- 48 patients randomized to intraventricular t-PA, 3mg/q12 vs saline
- Clot resolution 18%/day with t-PA vs 8%
- No difference in mortality or ventriculitis

ICP Elevations

ZERO	ONE	TWO	THREE
HOB>30deg Sedate Correct Na, T, vasogenic edema CPP>60-70mmHg	CSF DRAINAGE	DECOMPRESSIVE CRANIOTOMY	HYPOTHERMIA HYPERVENTILATION*
	Airway MANNITOL 3% SALINE 	SALINE BOLUS  PROPOFOL 	BP Augmentation  PENTOBARBITAL

*with cerebral O2 monitor

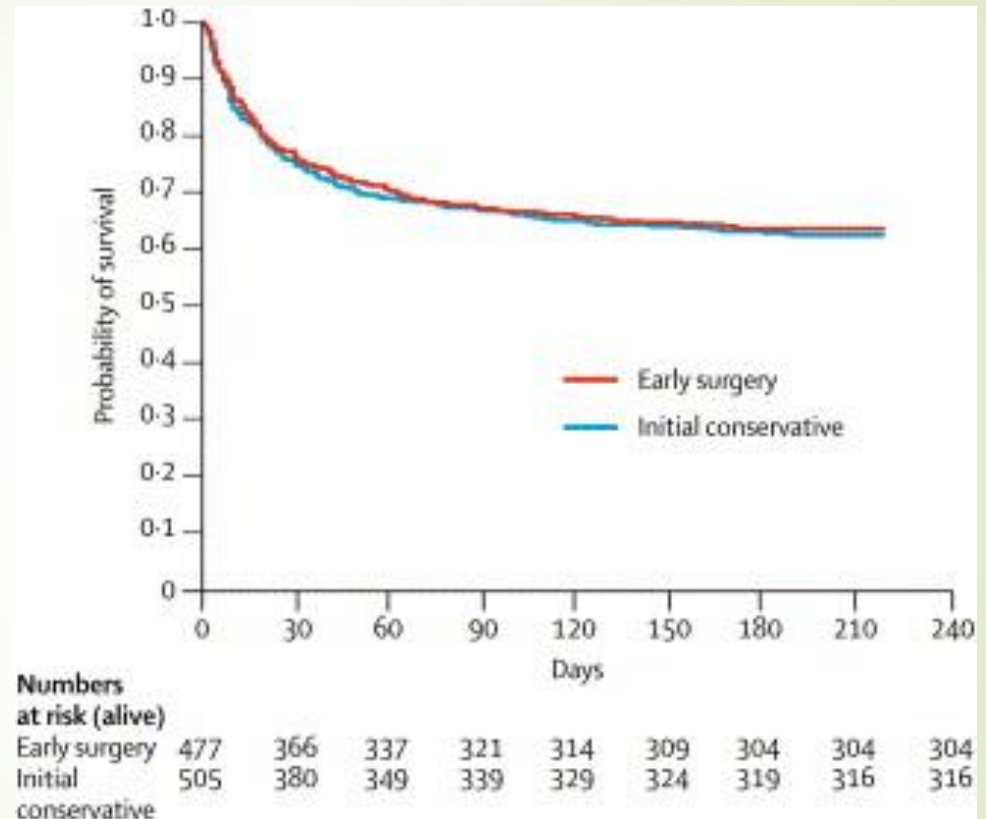


STICH Trial

- ▶ 1033 patients multicenter randomized controlled trial
- ▶ Supra tentorial ICH GCS>5, > 2cm diameter
- ▶ Surgery vs. medical management
- ▶ Early surgery < 72 hrs, mean 30 hrs
- ▶ Patients enrolled “clinical equipoise”

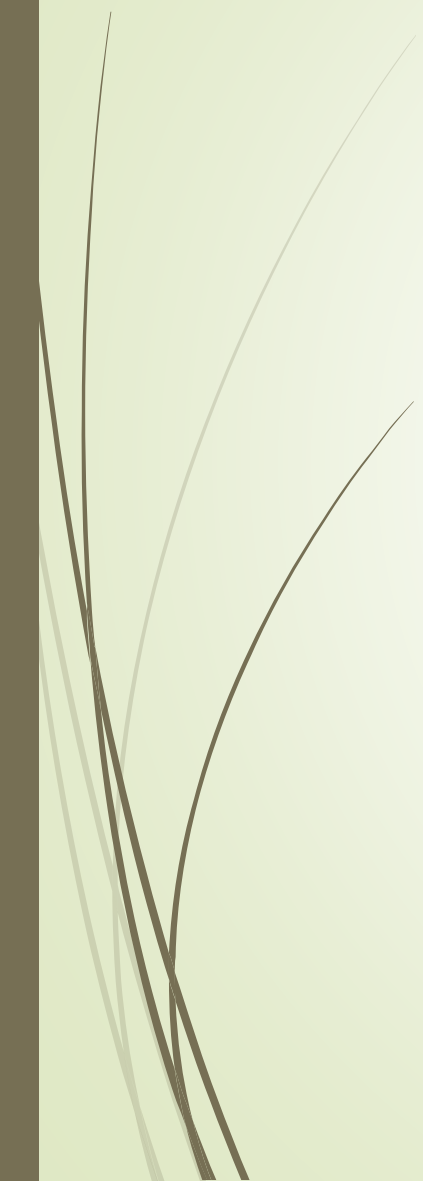
STICH Trial results and subgroup analysis

- No benefit
 - Age
 - GCS on admission
 - Lobar vs. Deep
 - Volume
 - Anticoagulant Rx
- Borderline Benefit:
if <1 cm from
cortex, 8%
absolute
reduction of poor
outcome





MISTIE phase II

- Minimally Invasive Surgery plus rt-PA
 - .3 mg vs 1 mg up to 9 doses
 - 93 patients randomized to medical treatment vs intervention
 - ICH removal rate higher in surgical group, higher but not significant mortality
 - One report of infection
 - Phase III Ongoing.
- 



Recombinant Factor VIIa in Acute ICH: FAST trial

- ▶ a randomized, double-blind, placebo-controlled, phase III study of 841 patients with ICH
- ▶ doses of 20 $\mu\text{g}/\text{kg}$, 80 $\mu\text{g}/\text{kg}$, or placebo within 4 h of ICH onset
- ▶ Mean ICH vol 23 ml, GCS 14
- ▶ increase in volume 29 ml for the placebo group, vs. 26 ml for the 20 $\mu\text{g}/\text{kg}$ group and 22 for the 80 $\mu\text{g}/\text{kg}$
- ▶ No difference in functional outcomes



Therapy: Blood Pressure

- Often elevated
- Too high: inc. risk of rebleeding/extension
- Too low: hypoperfusion (esp if chronic HTN) and ischemia
- Systolic <140 2015 AHA guidelines
- Maintain CPP > 60



IV antihypertensives

Drug	Dose	Mechanism of action/cautions
Labetalol	5–20 mg (intermittent boluses) every 15 min or 2 mg/min in continuous infusion	Mixed alpha and beta blocker/bradycardia, bronchospasm
Esmolol	250 mcg/kg (loading dose), then 25–300 mcg/kg per min (maintenance)	Beta blocker/bradycardia, bronchospasm
Nicardipine	5–15 mg/hr	Calcium channel blocker/tachycardia, AV block
Clevidipine	2-16 mg/hr	Calcium channel blocker/tachycardia, atrial fibrillation
Hydralazine	5-20 mg IV push every 30 mins	direct vasodilator/headache, neutropenia, lupus
Enalaprilat	1.25 – 5 mg IV psuh every 6 hours	ACE inhibitor/ angioedema hyperkalemia
Nitroprusside	0.1–10 mcg/kg per min	Direct vasodilator/increased ICP, thiocyanate toxicity



INTERACT 2

- 404 patients with ICH <6hours
- Randomized to SBP <140 vs 180
- Hematoma growth 14% vs. 36%
- Death at 90 days: 48 vs 49%
- mRankin in both : median of 2



ATACH-2

- Aggressive (< 140) vs Control 140-180mmgh
- No difference in mortality 38% vs 37%
- No Improvement in Quality of life
- Increased Renal failure in Aggressive arm



Conclusion

➤ Questions?

